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IS YELLOW FEVER CONTAGIOUS?

YOU ask, "Is yellow fever contagious?"

Let us first understand what is meant by the term *contagious;* and this preliminary proceeding involves an examination of the literature of the subject. Some years ago a broad distinction was made between the words *contagious* and *infectious,* as applied to diseases. Thus Dr. Ackerly, in 1832, wrote:

"The very evident distinction between contagious and infectious diseases has long since been made and employed in this country. Contagion is applied to those diseases which are propagated from one to another by contact or close approach, and which produce a like disease, as small-pox, measles, etc. Diseases produced by infection are those contracted from a vitiated atmosphere, as intermittent, remittent, bilious, and yellow fever. In 1819 and 1822 we had the yellow fever in New York, and the Board of Health shut up that part of the city where the disease prevailed by running fences across the streets leading to it. This was called the *infected district,* from the local causes contaminating the atmosphere and producing the infection. Beyond this district the city was not unhealthy, and those who were taken sick in the infected district, when removed to other parts not infected, recovered, and did not communicate the disease to others." (Hooper's Medical Dictionary, Fourth Am. Edition; edited by Samuel Ackerly. New York: 1832.)

La Roche wrote:

"I shall apply the word contagion to signify a poison, effluvium, or emanation, generated by morbid secretion in the course of a distemper, and possessing the power of inducing a like morbid action in healthy bodies whereby it is reproduced and indefinitely multiplied, whether by contact, near approach, or the medium of external bodies impregnated with it. All diseases that are so communicated are contagious. By infection, on the other hand, the reader will understand that power or poison which results from the decomposition of dead animal and vegetable substances, or other putrescent materials, if such exist, and through means of which a morbid state is induced in the system of individuals exposed to its action. In conformity with this restriction in the signification of the word infection, individuals laboring under the effects of exposure to the morbific cause in question are said to be *infected;* while the diseases resulting from that cause are denominated diseases by infection, or infections. The agent of infection usually exists in the state of gas or miasm, and as such occurs in filthy localities, houses, ships, jails, hospitals and cities as well as in marshes and fenny and low districts of country."

There is much confusion in the definitions. Dunglison says:

"Contagion and infection are generally esteemed synonomous. Frequently, however, the former is applied to diseases not produced by contact, while infection

is used for those that require positive contact. Diseases which cannot be produced in any other way than by contagion are said to have their origin in specific contagion."

The word *contagious* he defines as meaning "capable of being transmitted by immediate or mediate contact, communicable * * * * Commonly the epithet infection is applied to those that are communicated by immediate contact."

Webster quotes the definition of Dunglison as to the meaning of the word contagion, but, in speaking of *contagious* and *infectious*, says:

"*Contagious, Infectious.*—These words have been used in very diverse senses; but, in general, a *contagious* disease has been considered as one which is caught from another by contact, by the breath, by bodily effluvia, etc., while an *infectious* disease supposes some entirely different cause acting by a hidden influence, like the miasma of prison ships, of marshes, etc., *infecting* the system with disease. This distinction, though not universally admitted by medical men, as to the literal meaning of the words, certainly applies to them in their figurative use. Thus we speak of the *contagious* influence of evil associates; the *contagion* of bad example, the *contagion* of fear, etc., when we refer to transmission by proximity or contact. On the other hand, we speak of *infection* by bad principles, etc., when we consider any thing as diffused abroad by some hidden influence."

Beale, on disease germs, says:

"The minute contagious bioplast is less than the 1-100,000 of an inch in diameter, and often so very clear and structureless as to be scarcely distinguishable from the fluid in which it is suspended. Such a minute particle may readily be transferred from the affected organism to an apparently sound organism. It may be carried a considerable distance from its source without losing its marvelous power of causing, in the organism invaded, a series of changes resembling, and often in every minute particular, the phenomena which have occurred in the organism from which it was derived. And it is established that there exist different kinds of contagious living bioplasm, each capable of occasioning specific phenomena which distinguish it. The poison of small-pox will produce small-pox, not typhus fever, or measles, etc.; nor will any of these produce small-pox. Without, therefore, pretending to identify the actual particles of the living bioplasm of any contagious disease, or to be able to distinguish it positively from other forms of bioplasm, healthy and morbid, present in the fluids on the different free surfaces, and in the tissues in such vast numbers, I think the facts and arguments I have advanced prove: (1) That the contagious virus is living and growing matter; (2) That the particles are not directly descended from any form of germinal matter, or bioplasm of the organism of the infected animal, but they have resulted from the multiplication of particles introduced from without; (3) That it is capable of growing and multiplying in the blood; (4) That the particles are so minute that they readily pass through the walls of the capillaries, and multiply freely in the interstices between the tissue elements or epithelial cells; and *Lastly*, That these particles are capable of living under many different conditions; that they live and grow at the expense of various tissue elements, and retain their vitality, although the germinal matter of the normal textures, after growing and multiplying to a great extent, has ceased to exist."

The "American Cyclopedia" says, on Contagion:

"(Lat. *contagio*, from *con*, together, and *tangere*, to touch), primarily, the propagation of disease by contact. It is scarcely distinguished in usage, even by medical

writers, from infection, which designates the communication of disease by effluvia through the air. The contagious matter is the subtle, poisonous particles which diffuse themselves through the atmosphere, or attach themselves to various substances, as clothing and furniture. Concentrated in wool or fur, they retain their power of originating disease after being carried to a great distance. Among diseases propagated by immediate contagion, or direct application of the contagious matter, are syphilis, cow-pox, purulent ophthalma, and several others; among those communicated by remote contagion, or infection, are small-pox, measles, scarlet fever, mumps, and whooping cough."

Liebermeister groups together under the name *infectious diseases:*

"Those affections which we know, or at least believe, must originate through the infection of the system with certain peculiar poisonous matters, and which are mainly distinguished from the ordinary poisons by the fact that they can reproduce themselves under favoring conditions to an endless degree. The classification of this group of diseases will, of course, be modified from time to time, according to whatever theory of their etiology is maintained; and yet it is easy to foresee that, when investigations have been prosecuted further in this direction, infectious diseases will be found to occupy a far wider field than now is commonly given them.

"If the poisons which produce infectious diseases can reproduce themselves and multiply, we can understand why these diseases do not occur in a sporadic form, limited to single cases, but that they are, for the most part, *diseases of the country—pandemic diseases or epidemics*—for when they appear in a place, they usually attack numerous individuals simultaneously or successively. They are *endemic* when, as is the case with malarious diseases, they are limited to a certain territorial district, and are domiciled there continuously, or, at any rate, for an indefinitely long time. They are *epidemic* when they appear at intervals, and then again disappear, as is the case with the plague and the cholera."

Liebermeister again divides infectious diseases into miasmatic and contagious, speaking of contagion as a specific excitant of disease which originates in the organism suffering from the specific disease; while *miasm,* on the other hand, is used of a specific excitant of disease, which propagates itself outside of, and disconnected from a previously diseased organism. Contagion can be conveyed, by contact, from a diseased person to a sound one, produce the disease in him, and then again reproduce itself. Miasm originates from without; taken up into the body, it can call a specific disease into action, but it cannot spread the disease any further by conveying it from a diseased to a sound person.

Dujardin-Beaumetz * makes this distinction between infection proper and poisoning. He reserves the name poison to every chemical substance of mineral, vegetal or animal origin, which being introduced into the body, produces there disturbances more or less grave, more or less persistent, to the aggregate of which we

* *Therapeutic Gazette,* December 15, 1888.

apply the term *poisoning*. The name *infection* is reserved to designate the penetration of the body by a living principle, capable of multiplying itself in the organism, *i. e.*, of microbiotic origin.

Dr. J. S. Billings says:

"By 'contagion' we mean the communication of disease from one person to another, either by direct contact or through some medium, such as air, water, etc. It therefore includes 'infection,' which is now generally used as a synonym for it. The so-called infective diseases of modern German writers (Infectious—Krankheiten) include, besides what are commonly termed in English contagious diseases, the so-called miasmatic diseases."

Concerning the almost inextricable confusion into which this subject has been brought, Professor Welch, of Johns Hopkins University, says:

"It is gratifying, after so much strife, to be able to record this agreement of opinion as to the definition of infection and of infectious diseases in general. It is customary to classify infectious diseases etiologically into contagious, miasmatic, and miasmatic-contagious diseases. As to the significance of these terms, and particularly as to the real nature of the so-called miasmatic contagious diseases, there exists great confusion." * * * * * * * * * * *

"There is now tolerable unanimity of opinion as to the meaning attached to the terms infection and infectious diseases. Most recent authorities understand by infection the condition produced by the entrance and multiplication of pathogenic micro-organisms within the body. An infectious disease is one which is caused by the invasion and reproduction within the body of pathogenic micro-organism. To define an infectious agent as a specific poison capable of indefinite multiplication is only to express obscurely the idea just conveyed, for we know and can conceive of no poison capable of indefinite multiplication except a living organism. The analogies formerly drawn from the fermentation and the putrefaction of organic substances, and still preserved in the designation zymotic diseases, have lost all force as an opposing argument since it has been shown that these processes are produced by living organisms. In the absence of any other probable, I may say even conceivable, hypothesis, to refuse to accept the doctrine of a *contagium vivum* as applicable to all infectious diseases because it has been demonstrated only for certain of these diseases, is about as reasonable as to reject the law *omnis cellula e cellula* because this has not been proven for every cell or every species of cell."

For a long time the common itch was cited as an instance of contagious disease, and it was not until the parasite was discovered and brought into view that the true nature of the disease was understood, and it is quite probable that, as the knowledge progresses, the life history of the germ of most of the infective diseases will be understood, and it is clear from the citations above given that we must hold the infective diseases to include those we now term as a sub-division, namely, the contagious diseases. But in the progress of scientific knowledge that term has become more and more restricted. In the sense that infective

diseases are communicable, so far, yellow fever—itself an infectious disease—is contagious, for if we study its mode of progress, we shall see that yellow fever is transportable from place to place. Our every day experience teaches us this, when we see cases of the fever in the naval steamship "Boston," in New York, or in other northern ports where the disease is never known, except it is brought there by a patient.

We see the disease breaking out afresh after a long period of hibernation, as at Jackson, Mississippi. We have seen at Decatur, Alabama, during the past season an instance where the baggage of a person from an infected city left in the house of Mr. Spencer, must have been the means of starting the yellow fever in his case, because he had not been out of Decatur. There was no yellow fever prevailing in Decatur. There had been none for many years. We see, too, that persons subjected to its influence fall victims to the disease; as there are innumerable instances of healthy individuals going into the place where yellow fever prevails becoming stricken with the disease. Thus Doctor Posey, a previously healthy man, visited Maclenny, Florida, spent the night in going from house to house where the yellow fever is prevalent in a highly malignant form. He left the place, went to Camp Perry, and on the fifth day from the date of his exposure at Maclenny was attacked with a fever which proved to be yellow fever. The disease, therefore, is capable of being transported, and it is communicable to the healthy person.

The exact methods of its transmission are not at the present time definitely known, but we cannot shut our eyes to the plain facts. Consider the mode in which cholera is propagated. We find that all observers at present agree that cholera owes its effects to the operations of a germ known as the cholera or comabacillus; that this germ is abundantly found in the alimentary canal during the progress of the disease; is found in great numbers in the dejecta from the body; and whether we follow the lead of Pettenkofer in rejecting *in toto* the drinking water theory, *i. e.*, the theory that the germs are transmitted by the means of the drinking water, or whether by means of air, or by soil, or by X, we must admit that it is transmitted in some way, for a person previously healthy can acquire it. In this sense then cholera is contagious. Now, it does not follow that this sub-division of infectious diseases (those called contagious) are contagious in

an equal degree, for the degree simply depends upon the accessibility of the channel by which they gain access to the body, and in certain conditions of the system, as yet imperfectly understood, many of these germs become destroyed by the chemical action of the living body, and thus arises what is termed the individual susceptibility, or insusceptibility, to the operations of the infected germ. Now, although the germ of yellow fever has not been found in the blood by many observers, Freiré and a few others claim to have found it, but the weight of the testimony of competent observers at the present time is to the effect that the germ is in the alimentary canal, having the mucous lining of the stomach as its principal habitat and seat of operations; that the fever attending it is symptomatic; that in the hemorrhagic forms of yellow fever death takes place in almost the same manner as in acute poisoning. The doctrine of a quarter of a century ago that these germs (then hypothetical) when thrown off from the body must outside of it undergo a secondary change before becoming infectious seems absolutely without support in the light of the recently ascertained facts. I was once informed by a very intelligent shipmaster that having the yellow fever break out among the crew of his ship he was unable to arrest its progress from man to man until he caused all the cooking utensils on the ship to be thoroughly boiled, required the drinking water also to be boiled—in a word, adopted the precise precautions that would have been adopted in the case of infection by cholera. This was practiced in addition to the ordinary disinfection of the clothing and disinfection of the ship by the fumes of burning sulphur.

Let us summarize, then, the existing facts: Yellow fever is portable from place to place, is communicable to healthy persons, probably not by direct contact from the sick, but by the imbibition of specific germs.

We might construct a reasonable hypothesis that it is possible that the germs in sufficient number may be brought into the nasal air passages of a person, thence to the fauces, thence washed into the stomach by the first drink of water, or swallowed with the saliva—the saliva itself furnishing a culture-medium for the growth of the germ.

We may conclude, then, having consideration solely to the fact that yellow fever is a highly infectious disease of the mildly

contagious variety, and is to be prevented by the adoption of such measures as will destroy the germ and thus prevent its propagagation, and, at the same time, rendering sterile the soil or place whereon the germ shall fall.

JOHN B. HAMILTON.